Gerakoulis 113215

REMARKS

Claim 8 is amended to correct a typographical error.

Claims 1-20 were rejected under 35 USC 103 as being unpatentable over Balachandran et al, US Patent 6,108,374 in view of Chuang et al US Patent 6,477,210. Applicants respectfully traverse.

The Examiner asserts that Balachandran et al teach a method for use in a receiver for detecting and demodulating at least one of M-ary orthogonal symbol (MOK). In support of this assertion, the Examiner points to FIG. 11 (element 172) and to FIG. 12 (element 196), as well as to col. 3, lines 64-65, col. 10, lines 34-35, and col. 11, lines 14-15. Applicants respectfully disagree that what the Examiner points to supports the Examiner's assertion.

Element 172 of FIG. 11 merely depicts a general block diagram of a mobile, or base, receiver. Element 196 of FIG. 12 is an element (within a block diagram) titled "channel decoder and demodulator." What the combination of the two figures teaches is that a receiver has a channel decoder and demodulator. However, that teaches nothing about the particular signals that are decoded and demodulated. As for the cited text, the passage of col. 3, lines 64-65 states:

> ... M-ary constellation such as M-ary phase shift keying (PSK) or a M-ary quadrature amplitude modulation (QAM) scheme...

the passage of col. 10, lines 34-35 states:

> ... (possibly noisy and fading) to the receiver 172 it is input into a channel decoder and demodulator 174 which produces two outputs

and the passage of col. 11, lines 14-15 states:

> ... noisy and fading) to the receiver 196. After the information is received at the receiver 196 it is input into a channel decoder and demodulator.

Combining all of the above, it appears that Balachandran et al teach handling **signals that are either M-ary PSK signals, or M-ary QAM signals**. In contradistinction, claim 1 specifies M-ary MOK signals. Since MOK signals are different from PSK signals and from QAM signals, since using MOK signals instead of PSK or QAM signals is <u>not</u> suggested by Balachandran, and it certainly is not obvious to do so, and since the Chuang et al reference also does not suggest using MOK signals instead of PSK or QAM signals

(and the Examiner does not even assert that it does), applicants respectfully submit that claim 1 is not obvious in view of Balachandran taken together with Chuang et al.

The Examiner also asserts that Balachandran et al teach (a) demodulating the M-ary orthogonally modulated symbols, (b) calculating a metric and (c) decoding symbols, citing col. 10, lines 36-40, col. 11, lines 16-27, and col. 12, line 50.

It is true that at col. 10, lines 36-30 Balachandran et al teach demodulating to develop two outputs. As it is stated in col. 10, lines 37-40,

> The first output of the channel decoder and demodulator 174 is a value of the Viterbi decoder metric 176 for the received information signal. The second output of the channel decoder and demodulator 174 is the received data stream 186".

Indeed, in the col. 11 cited text Balachandran et al also teach a third output - one that estimates the signal strength and the bit error. The col. 12 citation, however, adds no new information.

Combining all of the cited passages, one may conclude that Balachandran et al teach demodulating, developing a metric, and decoding of symbols. However, this does not teach demodulating the M-ary MOK signals that claim 1 specifies. This is a second reason to hold that claim 1 is not obvious in view of the Balachandran et al and Chuang et al combination of references.

It is noted that the metric mentioned in the above-quoted passage is the "Viterbi metric," whereas in col. 3, line 54 (also cited by the Examiner) two other metrics are mentioned: the signal to interference and noise ratio (SINR) metric, and the frame error rate (FER) metric which, according to the text, "can be derived from the cumulative Eucledean distance metric corresponding to the decoded received sequence." The Examiner failed to point out to which metric the Examiner asserts a correspondence.

The Examiner also asserts that an average metric is described Balachandran et al treat in the abstract, col. 3, lines 48-55, col. 10, lines 44-45, and col. 11, lines 25-26, and that this average metric is functionally equivalent to a step of calculating probabilities of different symbols for each symbol instance, as claim 1 specifies. Applicants respectfully disagree.

The col. 3 text does not mention averaging. The cols. 10 and 11 citations do speak of a *moving average* value of the Viterbi decoder metric. In response to the

Examiner's assertion, applicants respectfully point out that an average, by definition, is a measure of a grouping that blurs the distinctions between the individual elements. Also, an average by itself is not a probability measure, and a moving average is certainly not "probabilities [note the plural form] of different symbols for each symbol instance." To have "probabilities," one must have a plurality of numbers/measures (a first attribute), and each of which must be between 0 and 1 (a second attribute). In the case of applicants' claim 1, each of the values must also represent the probability *of a particular symbol having been sent, given that a particular symbol was received* (a third attribute). A moving average metric (singular) is clearly not that. That is, it is not a plurality of items, it is not probabilities, and it is not probabilities of different symbols for each symbol instance. Hence, applicants respectfully submit that claim 1 is not obvious in view of the Balachandran et al reference in combination with the Chuang et al reference. That is, this difference forms a third reason to hold that claim 1 is not obvious in view of the Balachandran et al and Chuang et al combination of references.

The Examiner also asserts that Balachandran et al estimate a fading channel. In support of this assertion the Examiner cites col. 4, lines 25-28, 55-58, col. 10, lines 47-56, and col. 11, lines 14-35. Applicants respectfully disagree. The col. 4 citations speak of the complex "estimated channel coefficients." These coefficients indeed are estimates of the fading channel, and in that sense they represent precisely what claim 1 refers to. However, the text does NOT teach that those coefficients are *derived by the system*. Indeed, the text clearly states (col. 4, line 27) that the coefficients are "assumed available to the decoder" (emphasis supplied). There is no teaching as to who or what develops the channel estimates, or how those coefficients are developed. As for the col. 10 and 11 passages, they speak of the SINR, which is fed back, but which is wholly different from the channel coefficients (estimated or not). That is, the SINR is not an estimate of the fading channel. Moreover, it is not an estimate of the fading channel "responsive to calculating the probabilities." Respectfully, this difference forms another (fourth) reason to hold that claim 1 is not obvious in view of the Balachandran et al and Chuang et al combination of references.

As for the step of iteratively feeding the metric, the decoded symbols, the probabilities, and the channel estimates, back into the demodulating step, the Examiner

admits that Balachandran et al do not teach it. However, the Examiner asserts that Chuang et al teach this limitation. In support of this assertion, the Examiner cites element 160 of FIG. 1, the abstract, and col. 8, lines 15-45. Applicants respectfully disagree. First, element 160 of FIG. 1 does not feed any signal back. Rather, it is the Viterbi deconder 180 that feeds a signal back. (Probably, a mere typographical error by the Examiner.) Second, as stated in the first portion of the cited passage,

> The combined demodulates transformed (and optionally de interleaved) signal is them decoding using Viterbi decoder 180. The decoded combined demodulated transformed (and optionally de interleaved) signal is then fed back into channel estimator 165, which forwards channel estimation, which are added to the transformed signals that are forwarded to demodulators 160.

Clearly, the text supports the notion (present in FIG. 1) of the Viterbi decoder feeding back a signal to the channel estimator. The signal that is being fed is the "demodulated transformed (and optionally de interleaved) signal." It is not the (a) the metric, **and** (b) the decoded symbols, **and** (c) the probabilities, **and** (d) the channel estimates. It's just (b) – the decoded symbols.

Third, mere feedback, which Chuang et al describe, is not an iterative process (on any measurable time scale), and Chuang et al do not describe an iterative process in either the cited passage (as asserted by the Examiner) or elsewhere in the reference.

Fourth, aside from the fact that Chuang et al do not teach an iterative process, and do not even teach the feeding back of signals specified in claim 1, it is noted that applying the teachings of Chuang et al to Balachandran et al is inappropriate. First, it is inappropriate because Balachandran et al do not estimate the channel, whereas Chuang et al do. Second, even if the Examiner were to assert that the SINR is a channel estimate (which it is not), the feedback is not within the receiver (applied to the demodulator). Furthermore, claim 1 calls for (a) <u>re-demodulating</u>, and (b) <u>coherently</u>. Neither of these actions are taken by an combination of Balachandran et al and Chuang et al. In short, the "iteratively feeding" clause of claim 1 contains numerous attributes that by themselves form sufficient reasons to hold that claim 1 is not obvious in view of the Balachandran et la and Chuang et al combination of references.

Since essentially all of the claim 1 limitations are not suggested by the cited references, and each one of the not-suggested limitations forms a sufficient basis for

holding claim 1 not obvious, it is respectfully submitted that claim 1 is not obvious over Balachandran et al in view of Chuang et al.

Claims 2-12 depend on claim 1 and, therefore, they, too, are not obvious in view of the Balachandran et la and Chuang et al combination of references. Moreoever, at least some of the claims contain limitations that are not obvious in view of the Balachandran et la and Chuang et al combination of references.

Claim 3, for example, specifies noncoherent demodulation followed by coherent demodulation. The Examiner asserts that col. 1, line 35, of Chuang et al teaches coherent demodulation. However, the sentence that subsumes line cited by the Examiner merely states

> Though both differential and coherent demodulation ca be applied in a COFDM system, the latter leads to a performance gain of 3 to 4 dB in signal-to-noise ratio (RNR) with accurate channel estimation.

First, a teaching for handling coded frequency division multiplexing signals (COFDM) is clearly not a teaching of regarding M-ary PSK or QAM signals. Moreover, processing that is appropriate by OFDM is not obviously appropriate (and most of the time it is actually inappropriate) for other types of signals. Therefore, it is not obvious to apply teaching of Chuang et al the Balachandran et al system. The same is true relative to the signals defined in claim e (i.e., the M-ary MOK signals). Second, there is nothing in the quoted sentence that might suggest two type (coherent and noncoherent) demodulation. Third, there is nothing in the quoted sentence that suggests "a <u>first</u> instance of said demodulating step is performed noncoherently and <u>each successive</u> instance of said demodulating step for said signal is performed coherently" (emphasis supplied). Hence, it is respectfully submitted that the limitation introduced in claim 3 is clearly not obvious in view of the Balachandran et al and Chuang et al combination of references.

As for claims 4, and 5, the Examiner asserts that it would be obvious to implement testing for recognition of improvement and repeating steps b through f (of claim 1) iteratively. Applicants respectively disagree. Since neither of the references teaches, or suggests, iterative operations for iteratively improving detection, and since both references perform a detection once and try to do the best job possible with that single detection, the notion of an iterative operation is quite unobvious.

Regarding claims 7 and 8, the Examiner asserts that Balachandran et al teach log likelihood ratio. In support of this assertion the Examiner points to the abstract. Applicants respectfully traverse. The abstract merely teaches that a Viterbi decoder metric is created, and that it is mapped to a signal-to-noise (S/N) ratio. There is no mention of anything that characterizes this Viterbi metric as a "log likelihood ratio."

As for claim 9, the Examiner asserts that it would have been obvious to calculate chip probabilities after the step of calculating symbol probabilities. However, as explained above in connection with claim 1, Balachandran el al does not calculate symbol probabilities. The words "probability," or "probabilities" don't even appear in the Balachandran et al reference.

As for claim 12, the Examiner makes the bare conclusory statement of "it would have been obvious to one of ordinary skill in the art to implement," followed by a paraphrasing of the claim language. Absolutely no explanation is given as to why this step is believe obvious, and no support is provided based on teachings of the Balachandran et al reference. In applicants' view, claim 12 is not obvious because, for one, it specifies that only a known first chip is used in the first instance. There is no "first instance" in Balachandran et al, there is no "known first chip," and there is not a hint of using only a known first chip in any step of the their method. Claim 12 also specifies that unknown chips are used to estimate the fading channel. The Examiner has provided no reason for his obviousness conclusion regarding this part of claim 12 as well.

Claim 13 specifies that Balachandran et al teach a "receiver for detecting and modulating at least one signal of complementary code keying (CCK) symbols." Applicants respectfully disagree. As discussed above in connection with claim 1, Balachandran et al describe handling signals that are either M-ary PSK signals, or M-ary QAM signals -- not CCK signals. Therefore, limitations (a), (b) and (c) are not met by Balachandran et al, thereby making claim 13 not obvious.

Claim 13 also specifies adding an extra chip at a beginning of every symbol. The Examiner admits that Balachandran et al do not teach or suggest it, but asserts that Chuang et al teach adding an extra known chip at the beginning of every symbol, citing FIG. 1, col. 8, lines 20-21, and col. 20, line 53. Applicants respectfully disagree. First, FIG. 1 of Chuang et al does not show adding a chip (known or otherwise) to anything.

Nor does it show anything added to a symbol. As for the col. 8 citation, the text speaks of adding channel estimations to transformed signals. Adding channel estimations is not the same as adding a known chip (at any time, or in relation to anything). It is certainly not the same as adding a known chip at the beginning of every symbol. In fact, other than the notion of adding, there is nothing in the cited text that is relevant. As for the col. 20 citation, the line contains the word "sum," and it pertains to demodulators that are configured to receive a sum of outputs of FFT transforms. Clearly that is not relevant to the addition of an "extra known chip at a beginning of every symbol." Hence, limitation (d) of claim 13 is not suggested by either Balachandran et al or by Chuang et al, taken singly or in combination.

As for limitation (e), which defines a step of calculating probabilities, applicants traverse the Examiner's assertion and respectfully direct the Examiner's attention to the remarks above pertaining to a similar limitation in claim 1.

As for limitation (f), the Examiner points to col. 4, lines 12-28, but the cited text only teaches that the transmitted signal is complex, and that maximum likelihood decoding (e.g., Viterbi) can be used. There is no teaching or suggestion of calculating <u>expected</u> values of complex conjugates of every chip. It noted further that a chip is a component of a symbol, as taught by applicants at page 5, lines 14-24 of the patent application, and neither Balachandran et al nor Chuang et al teach chips. Accordingly, it is respectfully submitted that step (f) of applicants' claim 13 is not obvious in view of Balachandran et al and Chuang et al.

As for step (g), none of the citations presented by the Examine estimate the fading channel <u>at different chip positions within</u> symbols. As indicated above, the notion of a "chip" is not found in either of the references.

Lastly, regarding step (h), neither of the references suggest iterative feeding back of information -- and mere feedback does not correspond to iterative feeding back. Certainly there is no notion of re-demodulating symbols. The Examiner's attention is again respectfully directed to the arguments made in connection with a similar limitation in claim 1.

In short, in applicants' view none of the precise claim 13 limitations are suggested by the references, taken singly or together and, therefore, applicants respectfully submit that claim 13 is not obvious in view of Blachandran et al in view of Chuang et al.

As for claims 14-20, aside from the fact that they all depend on claim 13 and are, therefore, believed to be not obvious, at least some of the claims contains limitations that make the claims patentable over the cited art. Since these claims introduce notions that are found in earlier claims (that depended on claim 1) and which were discussed above, in the interest of brevity applicants respectfully direct the Examiner's attention to the remarks above.

In light of the above amendments and remarks, applicants respectfully submit that all of the Examiner's rejections have been overcome. Reconsideration and allowance of the outstanding claims are respectfully solicited.

Respectfully,
Diakoumis Parissis Gerakoulis
Saeed S. Ghassemzadeh

Dated: 3/15/04

By [signature]

Henry T. Brendzel
Reg. No. 26,844
Phone (973) 467-2025
Fax (973) 467-6589
email brendzel@comcast.net